REMARKS

The Examiner has rejected claims 1, 4, 7-8, 10-12, 15-19 and 21-22 under 35 U.S.C. § 103(a) as being unpatentable over Hongel, United States Patent No. 4,959,746 in view of Sellers, U.S. Patent No. 6,863,789 and Long, U.S. Patent No. 3,437,188. As hereinafter described, applicant has amended the claims to more particularly define the invention for which protection is sought. Reconsideration of the Examiner's rejections are respectfully requested in view of the following comments.

Claim 1 defines a device for preventing arcing between contacts of a switching device as the contacts of the switching device are opened. The switching device includes a coil for controlling the opening of the contacts. The device includes a coil suppression circuit connected in parallel to the coil. The coil suppression circuit dissipates the energy stored in the coil in response to the de-energization of the coil. The coil suppression circuit includes a first zener diode having a cathode operatively connected to the coil and the anode. In addition, the coil suppression includes a second zener diode having a cathode operatively connected to an anode of the first zener diode and an anode. A driver has an input operatively connected to the anode of first zener diode and an output. A first solid state switch has a gate operatively connected to output of the driver and is connected in parallel with the contacts. The first solid state switch is movable between an open position for preventing the flow of current therethrough and a closed position. The first zener diode generates a reference voltage in response to the de-energization of the coil. The driver closes the first solid state switch in response to the reference voltage across the first zener diode. As hereinafter described, nothing in cited references shows or suggests a device for preventing arcing between contacts of a switching device as the contacts of the switching device are opened that incorporates a coil suppression circuit disclosed that is activated in response to a reference voltage generated in response to de-energization of the coil.

The Hongel '746 patent discloses a relay contact protective circuit that prevents arcing between contacts of the switching device as the contacts of the switching device are opened. The device includes coil 10a (Fig. 4) for controlling the opening of contacts 10b. The coil suppression circuit s connected in parallel with coil 10a between the positive and negative terminals of coil 10a. As such, the coil suppression circuit takes its input from input 202, which energizes coil 10a. The coil suppression circuit includes a DC to DC converter that powers multivibrators 300 and 302. Referring to column 10, line 48+ of the '746 patent, activation of the DC to DC converter triggers multivibrator 300 to turn on MOSFETs 26 prior to the closing of contacts 10B so as to shunt current around the contacts. A short time thereafter, multivibrator 300 returns to its stable state and MOSFETs 26 turn off such that contacts 10B carry the full current of load 24. Id. at column 11, lines 51-53. Thereafter, if the control signal is turned off or falls below the hysteresis band of amplifier 206, converter 250 shuts down whereby coil 10A is de-energized. Multivibrator 302 operates when converter 250 is shut down and requires a source of power following termination of the isolated DC output. Id. at column 10, lines 65-67. When converter 250 shuts down, capacitor 346 discharges through diode 348 to provide power to multivibrator 302. Multivibrator 302 detects the termination of the isolated DC output via zener diode 356 and fires to again turn MOSFETs 26 on, prior to the opening of contacts 10B. Thereafter, multivibrator 300 returns to its stable state and MOSFETs 26 turn off with the load circuit open.

As described, converter 250 continually provides a DC voltage to multivibrators 300 and 302 during operation of the relay contact protective circuit. This structure is unlike the circuit of the present invention wherein coil suppression circuit is actuated only when the coil is de-energized. More specifically, claim 1 requires the first and second zener diodes to be reversed bias. As a result, the second zener diode prevents current from flowing through the first and second zener diodes when a voltage is provided across the coil. When the coil voltage is

removed, the coil releases all of its energy. A portion of the energy is released by the coil is dissipated by the first zener diode such that the first zener diode generates a reference voltage. In response this reference voltage, the driver closes the first solid state switch. Hence, unlike the circuit in the '746 patent, the coil suppression circuit of the present invention only operates in response to a reference voltage generated by de-energization of the coil.

It can be appreciated that given the continual presence of voltage across the coil suppression circuit during energization of the coil disclosed in the '746 patent, heat must be continually dissipated by the coil suppression circuit disclosed therein. This, in turn, increases the overall cost and may potentially decrease the reliability of the protective circuit disclosed in the '746 patent. On the other hand, the need for an arrangement to dissipate the heat generated by the coil suppression circuit is substantially reduced or eliminated in the device of independent claim 1 since the device only operates during de-energization of the coil.

Further, as explained above, the reference voltage provided by the zener diode in the device of claim 1 is generated by de-energization of the coil. This claimed structure differs substantially from the structure of the protective circuit disclosed in the '746 patent. In the protective circuit disclosed in the '746 patent, the coil suppression circuit is connected in parallel with coil 10a between the positive and negative terminals of coil 10a. As such, the coil suppression circuit takes its input from input 202, which energizes coil 10a. Consequently, the reference voltage is not generated by de-energization of the coil.

Neither the '789 or '188 patents can overcome the limitations of the Hongel reference. The '789 patent merely discloses a schematic view of a voltage clamp. Referring to column 4, lines 54+ of the '789 patent, the voltage clamp limits the amplitude of the voltage applied to the load. On the other hand, the '188 patent merely teaches the fact that a reference voltage may be obtained at a node between the diodes. However, just like the Hongel reference, nothing in the

'789 patent or the '188 patent teaches or suggests a device for preventing arcing between contacts of a switching device as the contacts of the switching device wherein:

1) the cathode of the first zener diode is connected to a coil;
2) the input of a driver is operatively connected to the anode of the first zener diode; and
3) a reference voltage is generated across the first zener diode by de-energization of the coil.

These structural elements are not contemplated by the '789 patent, the '188 patent or the '746 patent. Consequently, it is believed that claim 1 defines over the '746 patent and is in proper form for allowance.

Claims 4 and 7-11 depend either directly or indirectly from independent claim 1 and further defines a device not shown or suggested in the art. It is believed that claims 4 and 7-11 are allowable as depending from an allowable base claim and in view of the subject matter of each claim.

Referring to claim 12, a bypass circuit is provided for preventing arcing of an electrical energy path between first and second contacts of a switching device having a coil wherein the contacts opening close in response to energization of the coil. The bypass circuit includes a first switch connected in parallel with the contact of the switching device. The first switch is movable between a closed position with the contacts open and an open position with the contacts closed. A voltage reference device is connected to the coil. The voltage reference device provides a reference voltage generated by de-energization of the coil. An actuation circuit interconnects the coil and the first switch. The actuation circuit closes the first switch in response to the reference voltage.

As heretofore described with respect to independent claim 1, none of the cited references show or suggest a device for preventing arcing between contacts of a switching device as the contacts of the switching device wherein a reference voltage is provided by de-energization of the coil. Such a structure is entirely absent from cited references. Consequently, it is believed that independent claim 12 defines over the cited reference and is in proper form for allowance.

Claims 15-17 depend from claim 12 and further define a bypass circuit not shown in the art. It is believed that claims 15-17 are allowable as depending from an allowable base claim and in view of the subject matter of each claim.

Claim 18 defines a bypass circuit for preventing arcing of electrical energy passing to the first and second contacts of a switching device having a coil wherein the contacts open and close in response to energization of the coil. The bypass circuit includes a first switch connected in parallel with the contacts of the switching device. The first switch is movable between an open position and a closed position. An energy dissipation device is connected to the coil for providing a reference voltage for a predetermined time period generated by de-energizing coil. A driver interconnects the energy dissipation device in the first switch. The driver closes the first switch prior to the opening of the contacts in response to the reference voltage.

Again, as heretofore described with independent claims 1 and 12, nothing in the cited references show or suggest a bypass circuit for preventing arcing between contacts of a switching device as the contacts of the switching device wherein a reference voltage is provided by de-energization of the coil. Such a structure is entirely absent from cited references. Consequently, it is believed that independent claim 18 defines over the cited and is proper form for allowance. Claims 19-22 depend either directly or indirectly from independent claim 18 and further define a bypass circuit not shown or suggested in the art. It is believed that claims 19-22 are allowable as depending from an allowable base claim and in view of the subject matter of each claim.

Applicant believes that the present application with claims 1, 4, 7-12, and 15-22 is in proper form for allowance and such action is earnestly solicited. The Director is hereby authorized to charge payment of any additional fees associated with this or any other communication or credit any overpayment to Deposit Account No. 50-1170.

Respectfully submitted,

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